WHAT IS CLAIMED IS:

1. A method of establishing or restoring gap junctional intercellular communication (GJIC) in an endothelial cell layer, *in vitro*, comprising the steps of modulating the expression, organization, and assembly of at least one vascular gap junction protein or a combination of vascular gap junction proteins in the endothelial cell layer.

2. The method of claim 1 wherein the vascular gap junction proteins are vascular connexin proteins.

3. The method of claim 2 wherein the vascular connexin proteins are Cx37 Cx40, Cx43 or any combination thereof.

4. The method of claim 1 wherein the modulating step is accomplished by biophysical manipulation, genetic manipulation, or a combination of both biophysical manipulation and genetic manipulation.

5. A method of establishing or restoring GJIC in an endothelial cell layer *in vitro* comprising the steps of:

a) providing an endothelial cell layer;

b) exposing the endothelial cell layer to hemodynamic forces sufficient to induce the expression, organization and assembly of at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer; and

c) continuing to expose the endothelial cell layer to hemodynamic forces until the GJIC in the endothelial cell layer is established.

6. The method of claim 5 wherein the vascular junction proteins are Cx37 Cx40, Cx43 or any combination thereof.

7. A method of establishing or restoring GJIC in an endothelial cell layer *in vitro* comprising the steps of:

a) providing an endothelial cell layer comprising recombinant endothelial cells capable of expressing at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer; and

b) inducing expression of the vascular gap junction protein or combination of vascular gap junction proteins for a period of time suitable for establishing GJIC in the endothelial cell layer.

8. The method of claim 7 wherein the vascular gap junction proteins are Cx37 Cx40, Cx43 or any combination thereof.

9. A method of establishing or restoring GJIC in an endothelial cell layer *in vitro* comprising the steps of:

a) providing an endothelial cell layer comprising recombinant endothelial cells capable of expressing at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer;

b) exposing the endothelial cell layer to hemodynamic forces suitable for causing the expression, organization, and assembly of at least one vascular gap junction protein or a combination of vascular gap junction proteins in the endothelial cell layer; and

c) continuing to expose endothelial cell layer to hemodynamic forces until GJIC is established.

10. The method of claim 9 further comprising the step of inducing expression of the vascular gap junction protein or combination of vascular gap junction proteins prior to step (b).

11. The method of claim 9 wherein the vascular gap junction proteins are Cx37 Cx40, Cx43 or any combination thereof.

12. A vascular implant comprising an endothelial cell layer having established GJIC wherein the endothelial cell layer is produced by the method claim 5.

13. A vascular implant comprising an endothelial cell layer having established GJIC wherein the endothelial cell layer is produced by the method claim 7.

14. A vascular implant comprising an endothelial cell layer having established GJIC wherein the endothelial cell layer is produced by the method claim 9.

15. A vascular implant comprising a matrix with a monolayer of recombinant endothelial cells capable of expressing at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer.

16. The method of claim 6 wherein the vascular gap junction proteins are Cx37, Cx40, Cx43 or any combination thereof.

17. An endothelial monolayer sheet comprising an endothelial cell monolayer having established GJIC wherein the endothelial cell monolayer is produced by the method of claim 5.

18. An endothelial monolayer sheet comprising an endothelial cell monolayer having established GJIC wherein the endothelial cell monolayer is produced by the method of claim 7.

19. An endothelial monolayer sheet comprising an endothelial cell monolayer having established GJIC wherein the endothelial cell monolayer is produced by the method of claim 9.

20. A method for treating a patient in need of a vascular implant comprising:

a) seeding an implant matrix with a monolayer of endothelial cells comprising recombinant endothelial cells capable of expressing at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer;

b) exposing the endothelial cell layer to hemodynamic forces suitable for causing the expression, organization, and assembly of at least one vascular gap junction protein or a combination of vascular gap junction proteins in the endothelial cell layer;

c) continuing to expose endothelial cell layer to hemodynamic forces until GJIC is established; and

e) placing the implant matrix in a patient.

21. The method of claim 20 wherein the vascular implant is a stent, a shunt, a heart valve, or vascular graft.

22. A method for treating a patient in need of a vascular implant comprising:

a) seeding an implant matrix with cDNA encoding Cx37, Cx 40, Cx 43 or any combination thereof; and

b) placing the implant matrix in a patient.

23. A process for manufacturing an implant comprising the steps of:

a) providing a physiologically acceptable implant matrix;

b) seeding the implant matrix with a monolayer of endothelial cells comprising recombinant endothelial cells capable of expressing at least one vascular gap junction protein or a combination of vascular gap junction proteins suitable for establishing GJIC in the endothelial cell layer;

c) exposing the endothelial cell layer to hemodynamic forces suitable for causing the expression, organization, and assembly of at least one

vascular gap junction protein or a combination of vascular gap junction proteins in the endothelial cell layer; and

d) continuing to expose endothelial cell layer to hemodynamic forces until GJIC is established.

24. The method of claim 23 further comprising the step of inducing expression of the vascular gap junction protein or combination of vascular gap junction proteins prior to step (c).

25. The method of claim 23 wherein the matrix is selected from a) acellular or decellularized tissues, b) non-biodegradable, natural or synthetic polymers, or c) resorbable materials including biodegradable, natural or synthetic polymers.

26. The method of claim 23 wherein the matrix is a polymeric material selected from, low density polyethylene, polypropylene, polytetrafluoroethylene (PTFE), poly 2(hydroxyethylemetharcylate) poly HEMA, polyethylene tetraphalate (PET, Dacron), poly(lactide-co-glycolide), poly dimethylsiloxane, poly (etherurethane urea), knitted double velour polyethylene, or combinations thereof.

27. The method of claim 23 wherein the matrix is a resorbable material selected from, polyglycolides, polydioxanones, polyhydroxyalkanoates, polylactides, alginates, collagens, chitosans, polyalkylene oxalate, polyanhydrides, poly(glycolide-co-trimethylene carbonate), polyesteramides, polydepsipeptides, or combinations thereof.

28. The method of claim 23 wherein the matrix is an acellular material selected from pericardial matrix, matrices derived bovine ureter, submucosal collagen from small intestine, or pleural matrix.